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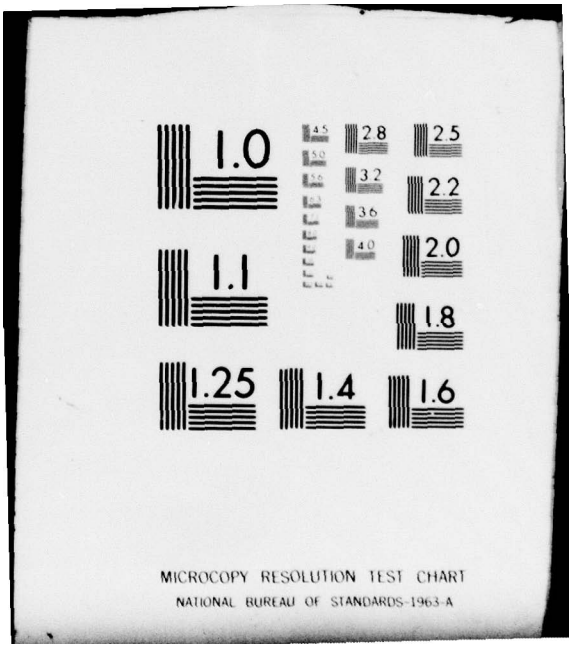
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WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts

(9) Quarterly progress rept.
1 Apr - 30 Jun 59.

(14) WHOI — Reference No. 59-55

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conducted during the period
1 April 1959 - 30 June 1959

Quarterly Progress Report
Submitted to the Bureau of Ships
Under Contract (15) NObsr-72521
November 1959

(11) Nov 59

(12) 20

APPROVED FOR DISTRIBUTION Bostwick H. Ketchum
Bostwick H. Ketchum,
Acting Director

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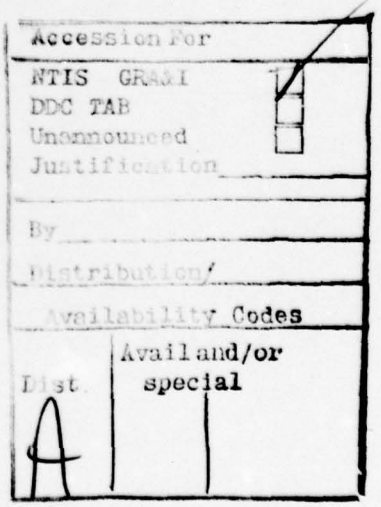

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INTRODUCTION

This quarter has been spent mainly in carrying out sound transmission studies and related environmental measurements. USNS CHAIN was engaged throughout the period in a major cruise to the Mediterranean Sea about a third of which has been used for the work of this contract, especially sound transmission both through the ocean and through the bottom.

Nearer Woods Hole, Dr. Voorhis has continued his transmission fluctuation studies between two fixed towers in Buzzards Bay, while Mr. Knott has undertaken improvements to the spark sound source for use in bottom reflection and transmission studies.

Data from previous cruises in our sound transmission program have been analyzed further. Some of this work has been reported by Mr. Johnson while work is still progressing on recordings made last summer (1958) in the Mediterranean Sea from YAMACRAW.

Progress on these and other projects is recounted in more detail below.

REPORTS

During the quarter, the following report was submitted for approval of classification and proposed distribution.

WHOI Ref. No. 59-22. 0.5 - 8 kc Sound Transmission in the Nova Scotian Sound Channel by H. R. Johnson, May 1959. (Confidential)

PAPERS

During the quarter the following paper was published.

WHOI Contr. No. 973. Geophysical Investigation of the Continental Margin between Cape Henry, Virginia and Jacksonville, Florida by J. B. Hersey, E. T. Bunce, R. F. Wyrick and F. T. Dietz, published April 1959 by the Geological Society of America, Vol. 70, pp. 437-466, 13 figures. (Unclassified)

The papers listed below report the results of research projects which, while not supported by the Contract Nobsr-72521, are of interest to the Bureau of Ships.

The following papers were published:

*WHOI Contr. No. 1011. Metabolically Induced Precipitation of Trace Elements from Sea Water by J. W. Graham, SCIENCE, Vol. 129, pp. 1428-1429, May 1959.

*WHOI Contr. No. 1017. On the Biological Origin of Manganese Rich Deposits of the Sea Floor by J. W. Graham and Susan Cooper, NATURE, Vol. 183, pp. 1050-1051, April 1959.

The following paper was submitted for publication:

WHOI Contr. No. 1052. Acoustically Monitored Bottom Coring by J. B. Hersey. Submitted to Deep Sea Research.

SOUND TRANSMISSION

Near Surface Transmission in Deep Water (Dr. Hays). UNCLASSIFIED

During this quarter we completed the ray diagram tracings to be used with the experimental transmission loss results of SUDEX II (WHOI Ref. No. 57-48).

In late May we reorganized the laboratory set-up for the summer analysis program. This included the testing of the new Electronic Associates computers for obtaining $\int p^2 dt$ (WHOI Ref. No. 53-46, p. 5) that were received at that time. The summer analysis program began with the YAMACRAW 10 sound transmission data from the western Mediterranean in the summer of 1958 (WHOI Ref. No. 59-4, p. 2).

---

*These two papers also were distributed as WHOI Reference No. 59-34.

In late May and June, USNS CHAIN was in the central Mediterranean and recorded near-surface sound transmission data at various locations. This was recorded on magnetic tape using the five-hydrophone vertical array as detecting assembly (WHOI Ref. No. 57-26, p. 9-10), and was accompanied by temperature measurements with the thermistor chain and velocity profiles taken with the National Bureau of Standards sound velocimeter.

Shallow Water Sound Transmission Analysis (Mr. Baxter) UNCLASSIFIED.

Due to the pressure of other work, we have made no further progress on shallow water sound transmission analysis. The present status of the work is described in WHOI Reference No. 59-47, p. 3.

Shallow Water Sound Transmission - Fluctuation Experiments (Dr. Voorhis). UNCLASSIFIED

With the towers placed in Buzzards Bay in April, we conducted the following experiment. A 600 cps c.w. source was mounted on a small platform which could be set on the bottom. The sound was received by two hydrophones mounted one above the other on one of the towers.

The detection system measured the relative phase and amplitude of the arrivals at the hydrophones as a function of range from the source. The experimental data now available indicate that surface waves are quite effective in causing changes in the phase and amplitude at the two hydrophones.

SUBMARINE GEOLOGY AND GEOPHYSICS

Seismic Refraction Studies - Mediterranean Sea (Mr. Fahlquist) UNCLASSIFIED

Planning and preparation for additional seismic refraction studies to be made during June and July in the western Mediterranean Sea were completed. Two listening and recording systems for seismic refraction studies were assembled, tested, and installed on USNS CHAIN, preparatory to the Mediterranean cruise (CHAIN 7). The Houston Technical Laboratory amplifiers and photographic recording oscillograph were transferred from USNS CHAIN to R/V WINNARETTA-SINGER (Musée Oceanographique de Monaco) at Monaco during the last week of June. An intensive seismic refraction program utilizing the two ships was begun on June 28. The area to be studied includes the Gulf of Genoa, the Gulf of Lyon, and the adjoining deep Algiers Provençal Basin. A towed string, with five BC-30 hydrophones, spaced one hundred feet apart was assembled for use in reflection studies of the bottom sediment in the Mediterranean Sea. This string will be towed at slow speeds from USNS CHAIN. The reflection studies will utilize the same amplifiers and recording system as used in the refraction work.

Seismic Refraction Observations in Buzzards Bay, Massachusetts (Miss E. T. Bunce and R. A. Phinney) UNCLASSIFIED

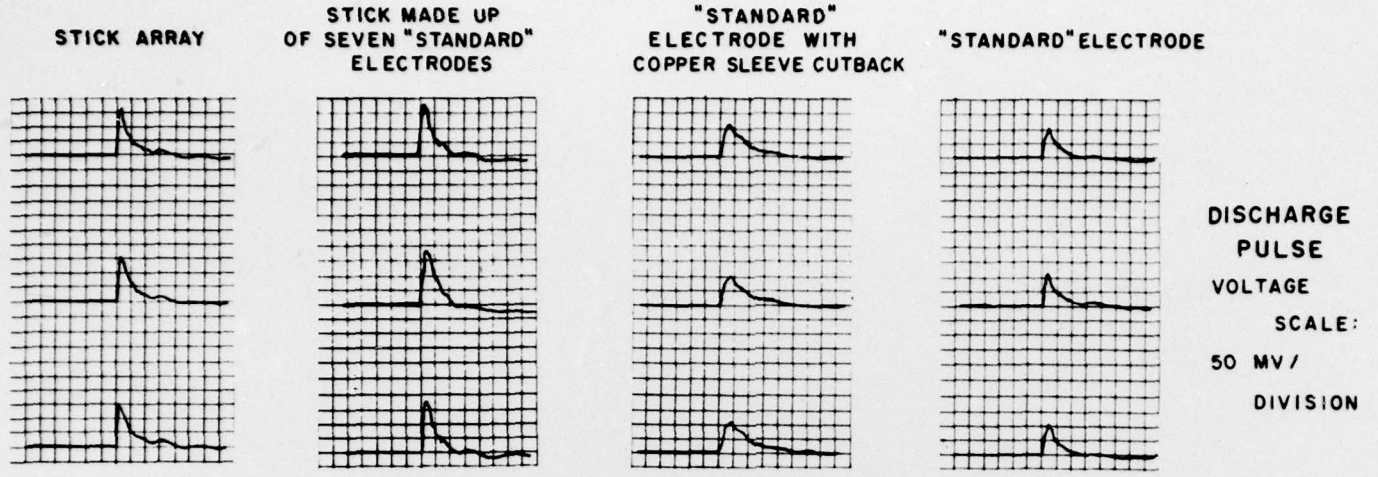
Analysis of the refraction data was essentially completed during this quarter. The results were reported at the meeting of the American Geophysical Union, Seismology Section, in May 1959. Preparation of the material for publication will continue in the next quarter.

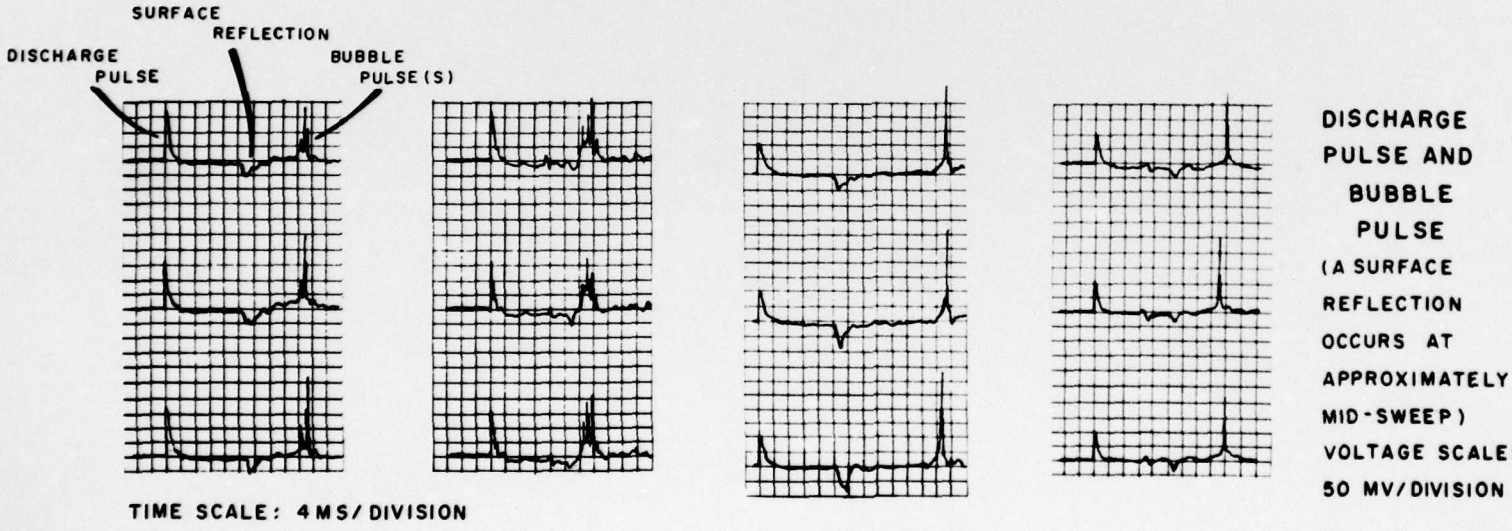
Seismic Reflection Studies with the Seismic Profiler (Mr. Knott)UNCLASSIFIED

Further studies were made of the underwater spark sound source. Figure 1 represents typical pressure-time curves for the measurements discussed in WHOI Ref. No. 59-47, p. 6. Three measurements are presented in each photograph as an indication of repeatability.

All measurements presented in the figure are of a discharge from a 6 mfd. capacitor bank at 10,000 volts. Range, depth, cable lengths and oscilloscope sensitivity were kept constant. Oscilloscope sweep speed was changed to allow the bubble pulse or pulses to record.

PRESSURE TIME CURVES FOR FOUR UNDERWATER SPARK SOUND SOURCES





PRESSURE DETECTED BY BC-30 ATLANTIC RESEARCH CORPORATION TRANSDUCER. DIRECT PATH 4 METERS; DEPTH: APPROXIMATELY 10 FEET; DISCHARGE CABLE 500 FT; ENERGY SOURCE: 6 MFD CHARGED TO 10,000 VOLTS.

FIG. 1

FIG. 1

UNCLASSIFIED

The stick array is a cylindrical design with a series of 1/16 inch tungsten electrodes pressed through the side of one inch rod of polyethylene into a center conductor of brass or copper.

The "standard electrode" is made up of an 1/8 inch tungsten electrode pressed coaxially into a half inch diameter polyethylene rod which is in turn pressed into a copper sleeve so that both electrode and sleeve are flush at the active end. The copper sleeve has been used to prevent fracture of the plastic insulation.

It is interesting to note the following: The discharge from the stick array has a sharper rise time than the others. The peak pressure of the two arrays is higher than that of the standard and cut-back. The discharge and bubble pulse contribution varies in shape from one electrode design to another. The bubble pulse is often of higher amplitude than the discharge pulse, but in the case of the array of seven standard electrodes the contribution is less than or equal to the discharge pulse amplitude. The growth of the bubble was felt to be limited by the closest discharge path of water defined by the sleeve of the standard electrode. After cutting back the sleeve about 3/8 inch, the bubble pulse interval increased suggesting a larger bubble was produced. The peak pressure (broad band) of the standard and cut-back are essentially equal, but the cut-back is a wider pulse.

Other experimental arrays are being made and their output will be examined.

ACOUSTIC INSTRUMENTATION

Towed Cable (Mr. Vine, Mr. Hoadley and Mr. Sullivan) UNCLASSIFIED

As indicated in a previous progress report (WHOI Ref. No. 59-18, p. 5) a ten-foot test length of a simplified towing cable was made and given preliminary testing. A 5/8" steel cable had swaged ferrules attached every 10" and free swinging sheet metal fairings were attached between ferrules. There was no vibration apparent to the hand or eye at speeds up to 10 knots.

Assembly of a 50' length of steel cable with electrical conductors in it was temporarily discontinued because of parts mismatching. A new set of ferrules is being obtained to finish a 50' length for use with an echo sounder.

Stereo-Photography of the Bottom of the Red Sea and Gulf of Aden (Dr. J. W. Graham and Miss Jane Broughton) UNCLASSIFIED

The developing and printing of all pictures taken with the Edgerton Stereo Camera on ATLANTIS 242 was completed on 25 June 1959. Prints of 2433 negatives have been numbered and filed. The lens to bottom depth and the length of bottom covered by one inch of picture has been noted on each print. Pictures of particular interest were enlarged to the maximum allowed by the enlarger in use. Extra copies of these were made, and are available for study.

Steel Towers in Buzzards Bay, Massachusetts (Mr. Sutcliffe) UNCLASSIFIED

On 12 April 1959, the tower was placed in position 41°34'47"N; 70°40'55"W as before. Figure 2 shows tower in position. These towers have subsequently been used in Dr. Voorhis' experiments discussed above, and will be left in position for use through the summer and fall.

During the last week in April, an angle iron track and two carriages, to carry hydrophones, were fabricated and attached by WHOI skin divers tc the tower. This arrangement has not proved satisfactory. A new track and carriage arrangement is contemplated.

APPENDIX

Use of Vessels

Operation of R/V BEAR during the quarter was as follows:

Cruise No.	Departure Return	Work Area	Principal Investigations	Scientist in charge
214	30 Apr. '59 1 May '59	Buzzards Bay	Shallow Water Sound Transmission	A. Voorhis

FIG. 2

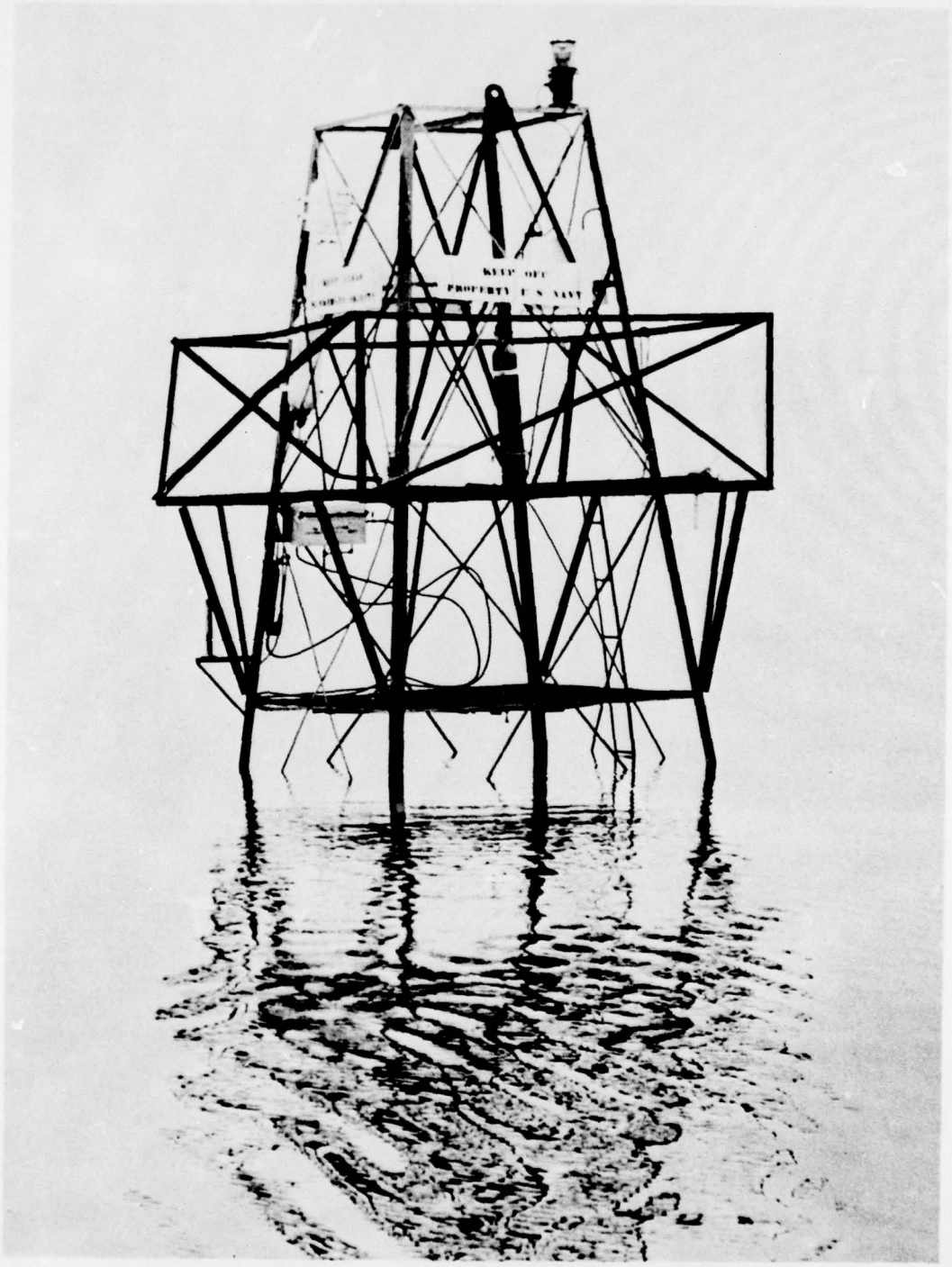


FIG. 2

Visitor's List

Mr. John Alden	Alden Electronics and Impulse Recording Equipment Company
Mr. Theodore E. Dinsmoor	American Machine and Foundry
Mr. Saul H. Silver	" " "
Mr. Joseph S. Ives, Jr.	" " "
Mr. Harry Turner	Electronics Associates
Mr. George Boehm	Fortune Magazine
Miss Lorraine Carson	" "
Dr. John C. Steinberg	New York
Mr. Ingjald Engelsen	Norway Defense Research Establishment
Mr. Tor Ingnar Wedervang	" " " "
Mr. J. F. McGrath	Office of Naval Research - Boston
Lt. Cdr. Stuart G. Murray	Office of Naval Research - Washington
Dr. J. M. Snodgrass	Scripps Institution of Oceanography
Mr. Robert Riggs	Sperry Rand Corporation
Mr. George Rand	" " "
Mr. Donald Jackson	" " "

Personnel List

J. B. Hersey	Geophysicist
A. C. Vine	Physical Oceanographer
E. E. Hays	Physicist
A. D. Voorhis	"
W. Dow	Electronics Engineer
W. E. Schevill	Assoc. in Oceanography

Personnel List cont.

R. H. Backus	Res. Assoc. in Marine Biology
J. W. Graham	Res. Assoc. in Geology
R. Pratt	" " "
H. R. Johnson	Res. Assoc. in Underwater Acoustics
L. Baxter, II	Res. Assoc. in Physics
Elizabeth T. Bunce	" " "
S. T. Knott	Res. Assoc. in Engineering
Helen M. Roberts	Assoc. in Mathematics
D. B. Foster	Administrative Assistant
L. C. Davis	Res. Assist. in Physics
Helen Stuart Graham	" " "
R. V. Olson	" " "
H. A. Cain	Res. Assist. in Engineering
A. L. Carter	" " "
R. Cotell	" " "
L. D. Hoadley	" " "
S. L. Stillman	" " "
P. B. Stimson	" " "
J. Sullivan	" " "
T. Sutcliffe	" " "
W. Watkins	" " "
A. Wing	" " "
W. E. Witzell	" " "
D. A. Fahlquist	Res. Assist. in Geophysics
D. R. Fink	" " "
Susan Cooper	Res. Assist. in Geology
T. R. Stetson	" " "
R. H. Weller	" " "

Personnel List cont.

A. L. Bradshaw	Res. Assist. in Mathematics
S. W. Bergstrom	Res. Assist. in Underwater Acoustics
W. M. Dunkle, Jr.	" " " "
C. B. Morehouse	Electrical Technician
C. S. Innis, Jr.	Draftsman
Jane Broughton	Technician
Helen Hays	"
D. E. Maddux	"
Margaret Brown	Secretary
Florence K. Mellor	"
Betty P. Ostiguy	"

Summer Personnel

High School Students -	Grant, Carlton, Jr. Pike, Douglas
High School Graduates -	de Ropp, Susan Morehouse, Diane
Undergraduates -	Bradley, Susan Castleman, Jean Emmanuel, Constantinos Fejer, Theodore Ketchum, Carl Moore, Dennis Myhrman, Matts Vaughn, Penelope
Cooperative Students -	Dersch, Eckhart - Antioch College Gifford, Charles - Northeastern Univ. Wilde, Donald - Northeastern Univ.

Summer Personnel (cont.)

College Graduates -

Allen, Richard
Barlow, Caroline
Hoskins, Hartley
Kittredge, Sally
Merz, James
Sandberg, Judy
Sethares, James

Graduate Students -

Breslau, Lloyd
Hauck, Anthony
Loughridge, Michael
Reitzel, John

Professors -

Fejer, Andrew - Aeronautical and Mechanical Engr., Illinois Inst. of Tech.
McCoy, Clinton - Biology, Wheaton College

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